

(51) International Patent Classification:

B29C 61/08, 57/02

A1

(11) International Publication Number:

WO 85/ 03251

(43) International Publication Date:

1 August 1985 (01.08.85)

(21) International Application Number: PCT/SE85/00030

(22) International Filing Date: 25 January 1985 (25.01.85)

(31) Priority Application Number: 8400399-5

(32) Priority Date: 27 January 1984 (27.01.84)

(33) Priority Country: SE

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(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), LU (European patent), NL (European patent), SE (European patent), US.

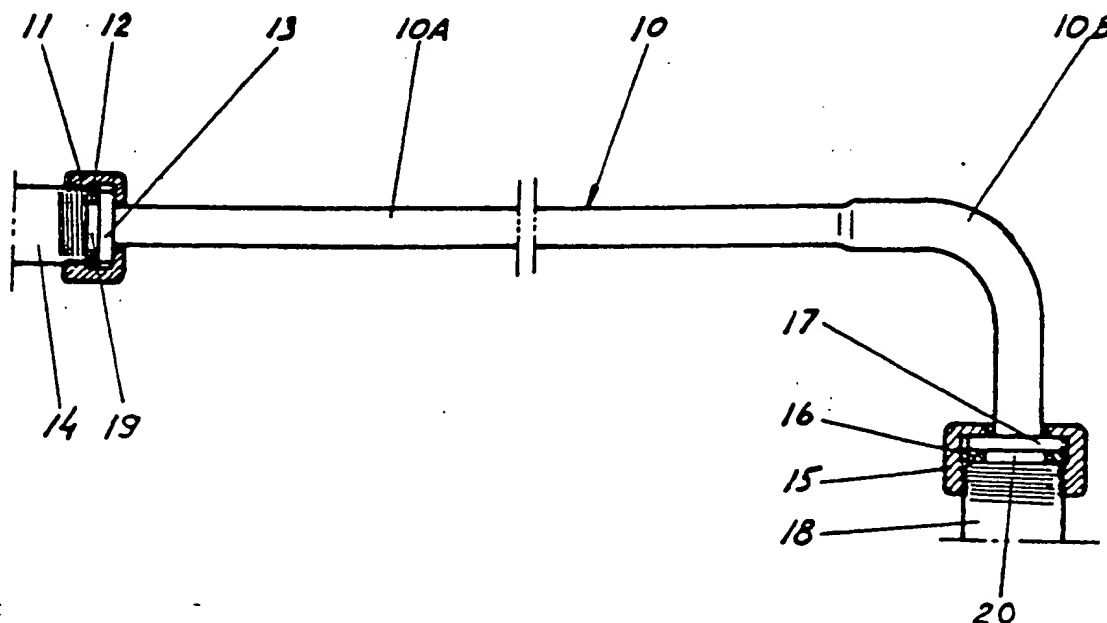
Published

With international search report.

In English translation (filed in Swedish).

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(54) Title: METHOD OF MANUFACTURING A PLASTIC TUBE



(57) Abstract

In a method of manufacturing a plastic tube, a tube blank having substantially constant outside and inside diameters is first manufactured of a plastic material having memory characteristics. This tube blank is then heated and reshaped to a tube (10) having a different outside and/or inside diameter. At least one section (10B) of the tube is then heated to the crystalline melting-point of the plastic material. This tube section then resumes the dimensions of the tube blank, so that the tube obtains at least two sections (10A, 10B) having different outside and/or inside diameters. By drawing the tube to a smaller outside diameter, it is possible to provide a tube having a thinner section (10A) and a thicker section (10B) by the heating to the crystalline melting-point. The thinner section gives the tube an increased flexibility, and the thicker section gives a better possibility to provide the tube with a large collar (17) for connecting the tube to another connection element, for example a water pipe (18).

This is different technology. They are using draw down and memory to change the U.D. This is similar to Shrink tubing but the opposite movement. I do believe however, that the France 17 AND 13 might well be foreseen as an infringement of my PATENT 4,525,136 - They can't successfully claim this patent as having anything to do with our current APPLICATION.

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# Method of manufacturing a plastic tube

## Technical Field

The present invention relates to a method of manufacturing a plastic tube. The method is primarily intended for manufacturing a flexible plastic tube which has a comparatively large collar and, for example, is suited for connecting a dish washing machine to a water pipe.

When connecting for example dish washing machines to water pipes it is desirable to use a flexible connecting tube between the water pipe and the water inlet of the dish washing machine to facilitate the installation work. It is also desirable to use plastic connecting tubes, for example of cross-linked polyethylene, because of the expense. The tube must be made comparatively thin to get a sufficient flexibility. In that case, however, it will become difficult to provide a sufficient large flange or collar at the end of the tube to make the end of the tube connectable to a water pipe or a valve, which normally is substantially thicker, with a connection eliminating the risk of leakage.

## Background Art

It is previously known, for example through DE A1 2 154 667, that some plastic materials under special circumstances have memory characteristics, so that if a body of such a material is reshaped by mechanical treatment, the body can resume its original shape when heated to the crystalline melting-point of the material. This feature of the material is utilized in the method according to the invention.

## Disclosure of Invention

The main object of the invention is to provide a simple method of manufacturing a plastic tube having at least one end with another outside and/or inside diameter than the rest of the tube, so that this tube end easier can be matched to necessary connection and attachment means.

However, the method can generally be used for manufacturing plastic tubes having at least one section with a different outside and/or inside diameter as compared with the rest of the tube. This has been obtained by giving the method  
5 according to the invention the features set forth in the claims.

#### Brief Description of Drawing

One example of the method according to the invention will now be described below with reference to the accompanying drawing showing a side view of a connecting tube for  
10 a dish washing machine.

#### Best Mode for Carrying Out the Invention

The connecting tube 10 shown on the drawing comprises a thinner section 10A and a thicker section 10B. The thin  
15 tube section 10A is at its free end provided with a connection means comprising a nut 11 and a packing ring 12. The nut and the packing ring abut from opposite sides a collar 13 provided on the tube section. The nut is provided with internal threads and is intended to be attached by screwing  
20 on the end of a connection tube 14 of a dish washing machine. The packing ring 12 will then be sealingly positioned between the collar 13 of the tube section 10A and the end of the connection tube 14. The thick tube section 10B is also at its free end provided with a connection means comprising  
25 a nut 15 and a packing ring 16. The nut and the packing ring abut from opposite sides a collar 17 provided on the tube section. The nut 15 is provided with internal threads and is intended to be attached by screwing on the end of a water pipe 18. The packing ring 16 will then be  
30 sealingly positioned between the collar 17 of the tube section 10B and the end of the water pipe 18. The plastic tube is at both ends provided with projecting portions 19 and 20, respectively, in front of the collars 13 and 17, respectively. These projecting portions 19, 20 are intended for  
35 controlling and retaining the packing rings 12 and 16, respectively. The thick tube section 10B is bent to an angle of 90°.

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In the connecting tube shown on the drawing the section 10A has an outside diameter of 10 millimetres and the section 10B an outside diameter of 12 millimetres.

The connecting tube shown on the drawing has been  
5 manufactured in the following way. A tube blank in the shape of a tube having an outside diameter of 12 millimetres has first been manufactured of a plastic material having memory characteristics, i. e. of a plastic material having the feature that it after a change of shape resumes the  
10 original shape when heated to a particular temperature, the so called crystalline melting-point. The tube blank has then been reduced by drawing, so that the outside diameter of the tube has become 10 millimetres. After the reduction the end sections of the tube have been heated to the crystalline melting-point. These sections have then resumed the  
15 original size, i. e. an outside diameter of 12 millimetres. A collar has then been formed in a conventional way at both ends of the tube. At one end only the portion intended for forming the collar has been heated, while at the other end  
20 a longer portion has been heated for forming the section 10B. This end section 10B has been bent to an angle of 90° to the shape shown on the drawing.

In the described example the tube consists of cross-linked polyethylene that has a crystalline melting-point of  
25 about 130°C.

As is evident from the drawing, the collar 17 provided at the free end of the thicker section 10B has a substantially larger diameter than the collar 13 provided at the free end of the thinner section 10A. This larger diameter  
30 can easily be provided, because the collar is formed on a tube having a larger outside diameter. Therefore, the collar can easily be made sufficiently large to fit the tube dimensions normally used for water pipes and required for connecting machines, so that leakageproof connections can  
35 be provided. At the same time, the connecting tube 10 has a sufficient flexibility due to the fact that the section 10A has a smaller outside diameter and, thus, is thinner.

While only one example of the method according to the invention has been given above, it is evident that many variations and modifications are possible within the scope of the invention. The initially manufactured tube blank can  
5 for example be machined in such a way that the wall thickness is maintained or changed. The outside diameter of the tube can be reduced, maintained or increased. Thus, a section of a tube, for example, can be provided with a thicker wall than the rest of the tube by heating to the crystalli-  
10 ne melting-point. This possibility can be utilized for manufacturing a tube having thicker walls at the tube ends, so that the ends of the tube easier can be provided with internal or external threads for connection purposes. Furthermore, any portion or section of the reduced tube can be  
15 heated to the crystalline melting-point, so that this portion or section resumes the original shape and thus obtains other dimensions than the rest of the tube. Finally, also the inside diameter can be varied and several sections of the reduced tube can be heated to the crystalline melting-  
20 point.

## Claims

1. Method of manufacturing a plastic tube, in which first a tube blank having substantially constant outside and inside diameters is manufactured of a plastic material with memory characteristics and then this tube blank is heated and re-  
5 shaped to a tube (10) having a different outside and/or inside diameter, characterized in that a section (10B) of the tube is heated to the crystalline melting-point of the plastic material, so that this section of the tube resumes the dimensions of the tube blank, giving the tube at least  
10 two sections (10A,10B) having different outside and/or inside diametres.
2. Method according to claim 1, characterized in that the tube blank is reduced by drawing, so that the resulting  
15 tube obtains a smaller outside diameter than the tube blank.
3. Method according to claim 2, characterized in that one end section (10B) of the tube (10) is heated to the crystalline melting-point of the material, so that this end section obtains a larger outside diameter than the rest  
20 (10A) of the tube.
4. Method according to claim 3, characterized in that at least a portion of the heated tube section (10B), which has resumed its original diameter, is pressed to a collar (17).
5. Method according to claim 4, characterized in that the  
25 end (20) of the heated tube section (10B) is so shaped that it projects in front of the portion pressed to a collar (17).
6. Method according to claim 1, characterized in that the tube blank is drawn to a smaller wall thickness and that at  
30 least one end of the resulting tube is heated to the crystalline melting-point of the plastic material, so that the tube obtains one end having a larger wall thickness than the rest of the tube.
7. Method according to claim 6, characterized in that the  
35 end of the tube having a larger wall thickness than the rest of the tube is provided with threads.

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